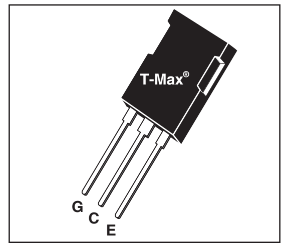
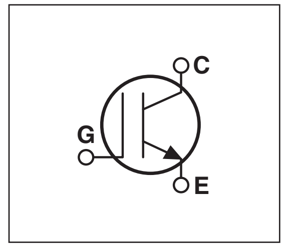
ADVANCED POWER TECHNOLOGY®

600V
APT100GN60B2
APT100GN60B2G*

*G Denotes RoHS Compliant, Pb Free Terminal Finish.

Utilizing the latest Field Stop and Trench Gate technologies, these IGBT's have ultra low $V_{CE(ON)}$ and are ideal for low frequency applications that require absolute minimum conduction loss. Easy paralleling is a result of very tight parameter distribution and a slightly positive $V_{CE(ON)}$ temperature coefficient. A built-in gate resistor ensures extremely reliable operation, even in the event of a short circuit fault. Low gate charge simplifies gate drive design and minimizes losses.





- **600V Field Stop**
- **Trench Gate: Low $V_{CE(on)}$**
- **Easy Paralleling**
- **6μs Short Circuit Capability**
- **Intergrated Gate Resistor: Low EMI, High Reliability**

Applications: Welding, Inductive Heating, Solar Inverters, SMPS, Motor drives, UPS

MAXIMUM RATINGS

All Ratings: T_C = 25°C unless otherwise specified.

Symbol	Parameter	APT100GN60B2(G)	UNIT
V_{CES}	Collector-Emitter Voltage	600	Volts
V_{GE}	Gate-Emitter Voltage	±30	
I_{C1}	Continuous Collector Current ⑧ @ T_C = 25°C	229	Amps
I_{C2}	Continuous Collector Current ⑧ @ T_C = 110°C	135	
I_{CM}	Pulsed Collector Current ①	300	
SSOA	Switching Safe Operating Area @ T_J = 175°C	300A @ 600V	
P_D	Total Power Dissipation	625	Watts
T_J,T_{STG}	Operating and Storage Junction Temperature Range	-55 to 175	°C
T_L	Max. Lead Temp. for Soldering: 0.063" from Case for 10 Sec.	300	

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic / Test Conditions	MIN	TYP	MAX	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage (V_{GE} = 0V, I_C = 4mA)	600			Volts
$V_{GE(TH)}$	Gate Threshold Voltage (V_{CE} = V_{GE}, I_C = 1mA, T_j = 25°C)	5.0	5.8	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 100A, T_j = 25°C)	1.05	1.45	1.85	
	Collector-Emitter On Voltage (V_{GE} = 15V, I_C = 100A, T_j = 125°C)		1.87		
I_{CES}	Collector Cut-off Current (V_{CE} = 600V, V_{GE} = 0V, T_j = 25°C) ②			25	μA
	Collector Cut-off Current (V_{CE} = 600V, V_{GE} = 0V, T_j = 125°C) ②			TBD	
I_{GES}	Gate-Emitter Leakage Current (V_{GE} = ±20V)			600	nA
$R_{G(int)}$	Intergrated Gate Resistor		2		Ω

CAUTION: These Devices are Sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

APT Website - http://www.advancedpower.com

DYNAMIC CHARACTERISTICS

Symbol	Characteristic	Test Conditions	MIN	TYP	MAX	UNIT
C_{ies}	Input Capacitance	**Capacitance** $V_{GE} = 0V$, $V_{CE} = 25V$ f = 1 MHz		6000		pF
C_{oes}	Output Capacitance			560		
C_{res}	Reverse Transfer Capacitance			200		
V_{GEP}	Gate-to-Emitter Plateau Voltage	Gate Charge $V_{GE} = 15V$ $V_{CE} = 300V$ $I_C = 100A$		9.5		V
Q_g	Total Gate Charge ③			600		nC
Q_{ge}	Gate-Emitter Charge			45		
Q_{gc}	Gate-Collector ("Miller") Charge			340		
SSOA	Switching Safe Operating Area	$T_J = 175°C$, $R_G = 4.3\Omega$ ⑦, $V_{GE} =$ 15V, L = 100µH, $V_{CE} = 600V$	300			A
SCSOA	Short Circuit Safe Operating Area	$V_{CC} = 600V$, $V_{GE} = 15V$, $T_J = 125°C$, $R_G = 4.3\Omega$ ⑦	6			µs
$t_{d(on)}$	Turn-on Delay Time	**Inductive Switching (25°C)** $V_{CC} = 400V$ $V_{GE} = 15V$ $I_C = 100A$ $R_G = 1.0\Omega$ ⑦ $T_J = +25°C$		31		ns
t_r	Current Rise Time			65		
$t_{d(off)}$	Turn-off Delay Time			310		
t_f	Current Fall Time			55		
E_{on1}	Turn-on Switching Energy ④			4750		µJ
E_{on2}	Turn-on Switching Energy (Diode) ⑤			5095		
E_{off}	Turn-off Switching Energy ⑥			2675		
$t_{d(on)}$	Turn-on Delay Time	**Inductive Switching (125°C)** $V_{CC} = 400V$ $V_{GE} = 15V$ $I_C = 100A$ $R_G = 1.0\Omega$ ⑦ $T_J = +125°C$		31		ns
t_r	Current Rise Time			65		
$t_{d(off)}$	Turn-off Delay Time			350		
t_f	Current Fall Time			85		
E_{on1}	Turn-on Switching Energy ④			5000		µJ
E_{on2}	Turn-on Switching Energy (Diode) ⑤			6255		
E_{off}	Turn-off Switching Energy ⑥			3300		

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to Case **(IGBT)**			.21	°C/W
$R_{\theta JC}$	Junction to Case **(DIODE)**			N/A	
W_T	Package Weight		5.9		gm

① Repetitive Rating: Pulse width limited by maximum junction temperature.

② For Combi devices, I_{ces} includes both IGBT and FRED leakages

③ See MIL-STD-750 Method 3471.

④ E_{on1} is the clamped inductive turn-on energy of the IGBT only, without the effect of a commutating diode reverse recovery current adding to the IGBT turn-on loss. Tested in inductive switching test circuit shown in figure 21, but with a Silicon Carbide diode.

⑤ E_{on2} is the clamped inductive turn-on energy that includes a commutating diode reverse recovery current in the IGBT turn-on switching loss. (See Figures 21, 22.)

⑥ E_{off} is the clamped inductive turn-off energy measured in accordance with JEDEC standard JESD24-1. (See Figures 21, 23.)

⑦ R_G is external gate resistance, not including $R_{G(int)}$ nor gate driver impedance. (MIC4452)

⑧ Continuous current limited by package pin temperature to 100A.

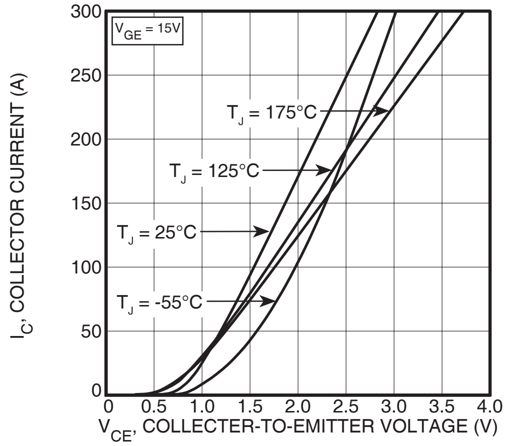


FIGURE 1, Output Characteristics(T_J = 25°C)

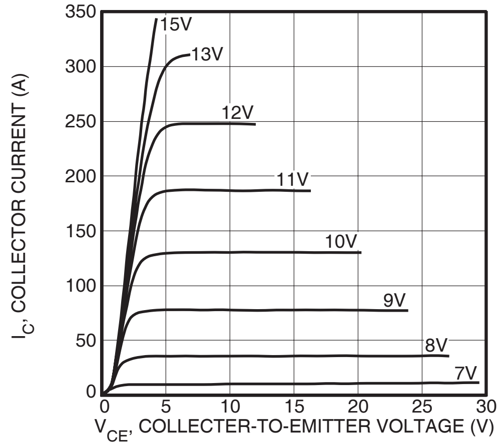


FIGURE 2, Output Characteristics (T_J = 125°C)

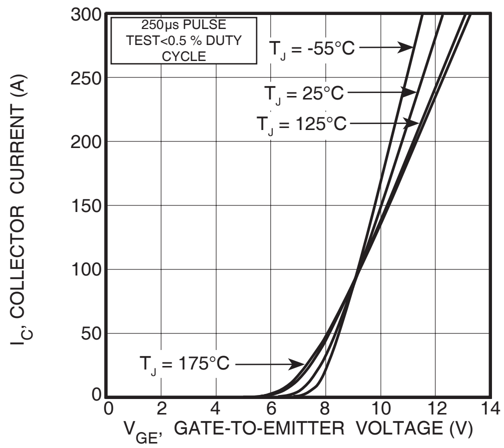


FIGURE 3, Transfer Characteristics

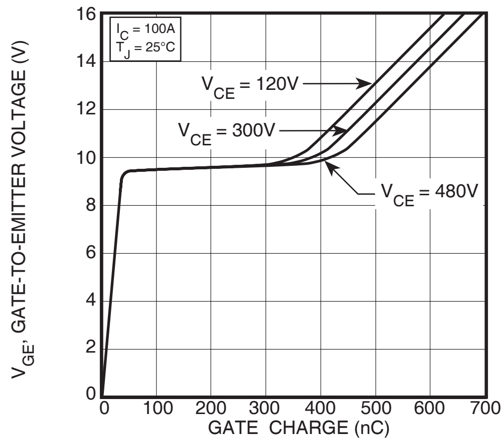


FIGURE 4, Gate Charge

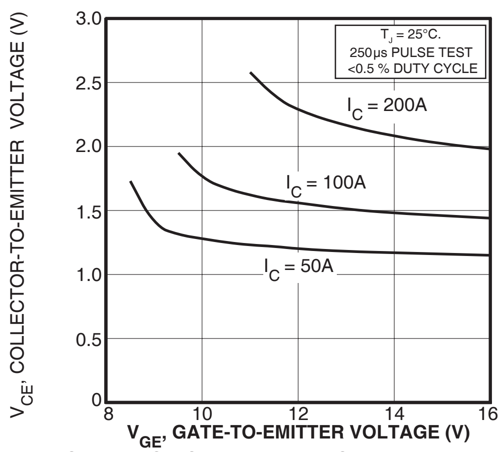


FIGURE 5, On State Voltage vs Gate-to- Emitter Voltage

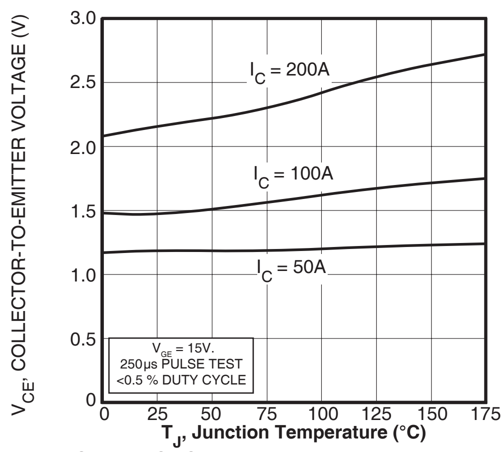


FIGURE 6, On State Voltage vs Junction Temperature

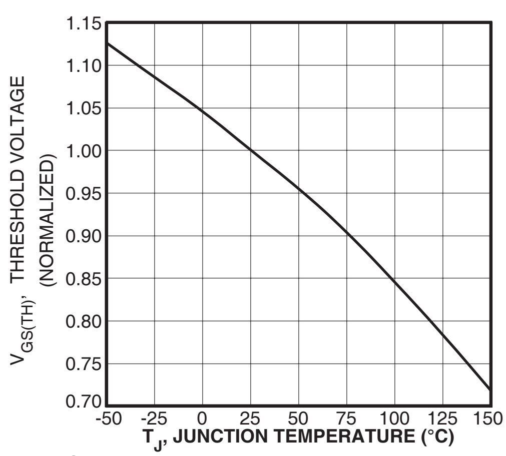


FIGURE 7, Threshold Voltage vs. Junction Temperature

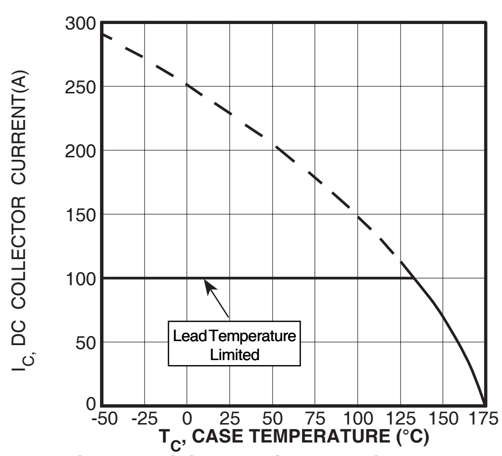


FIGURE 8, DC Collector Current vs Case Temperature

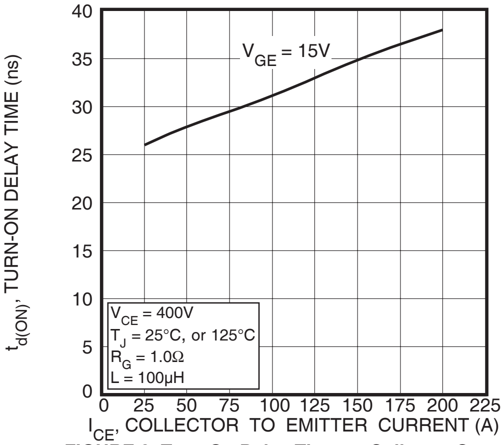


FIGURE 9, Turn-On Delay Time vs Collector Current

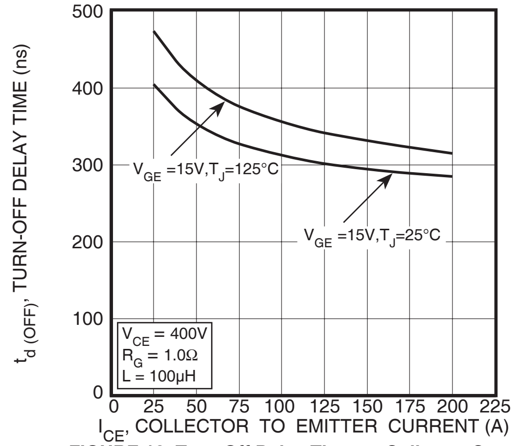


FIGURE 10, Turn-Off Delay Time vs Collector Current

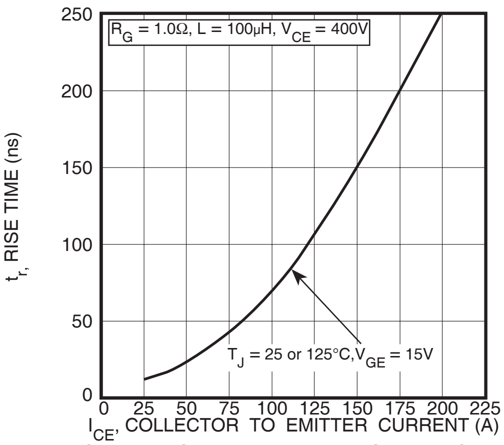


FIGURE 11, Current Rise Time vs Collector Current

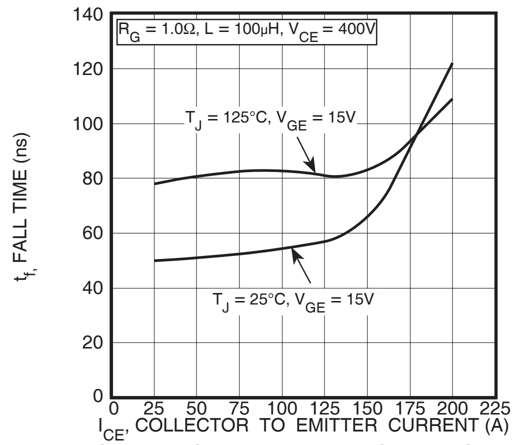


FIGURE 12, Current Fall Time vs Collector Current

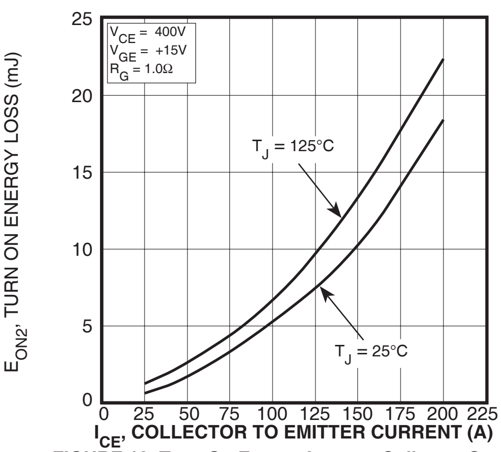


FIGURE 13, Turn-On Energy Loss vs Collector Current

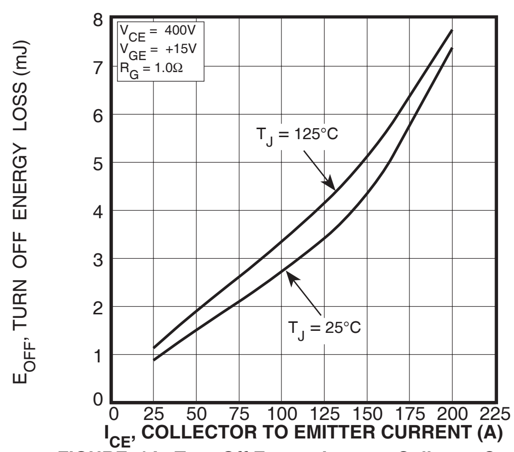


FIGURE 14, Turn Off Energy Loss vs Collector Current

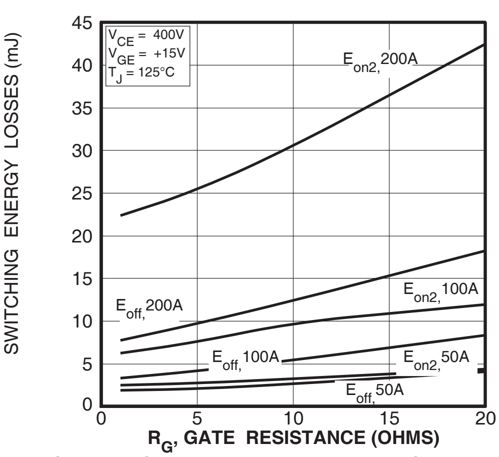


FIGURE 15, Switching Energy Losses vs. Gate Resistance

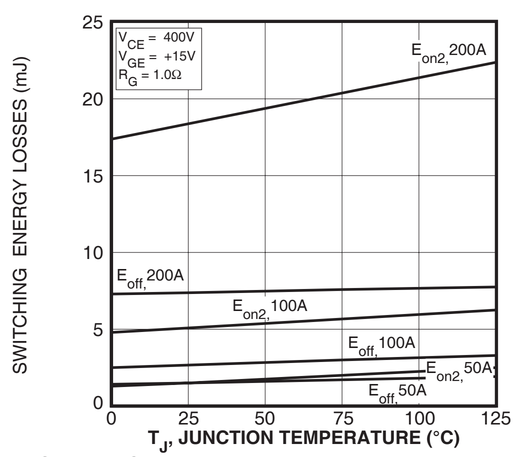


FIGURE 16, Switching Energy Losses vs Junction Temperature

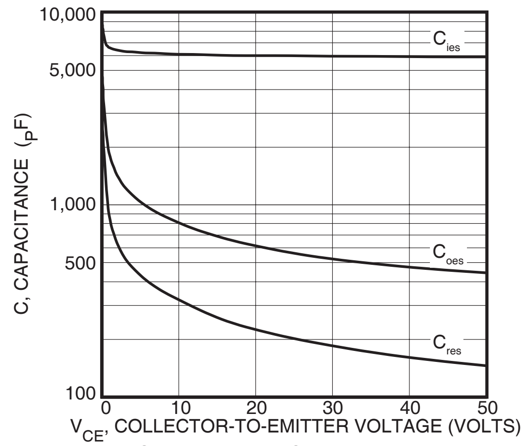


Figure 17, Capacitance vs Collector-To-Emitter Voltage

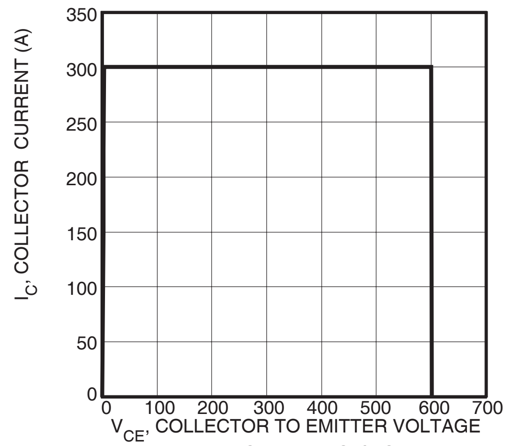


Figure 18,Minimim Switching Safe Operating Area

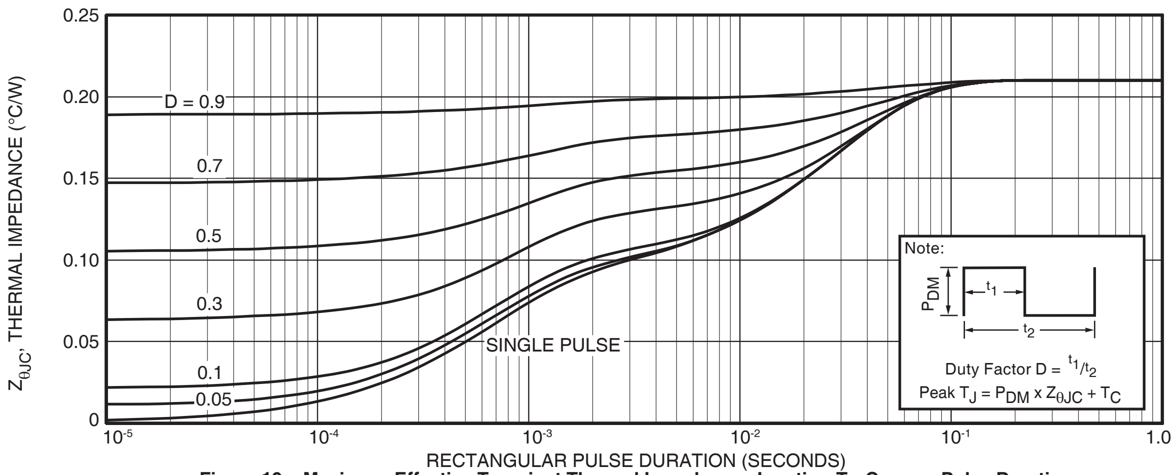


Figure 19a, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

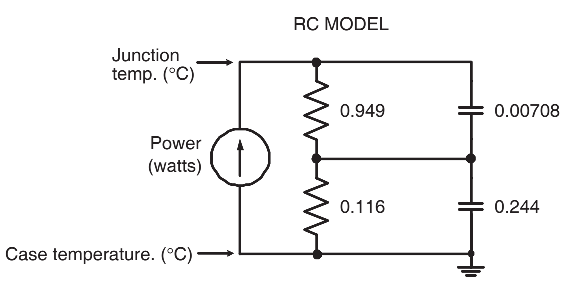
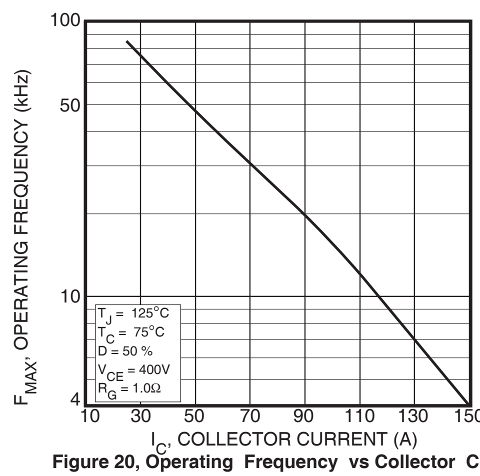


FIGURE 19b, TRANSIENT THERMAL IMPEDANCE MODEL



$$F_{max} = \min(f_{max}, f_{max2})$$

$$f_{max1} = \frac{0.05}{t_{d(on)} + t_r + t_{d(off)} + t_f}$$

$$f_{max2} = \frac{P_{diss} - P_{cond}}{E_{on2} + E_{off}}$$

$$P_{diss} = \frac{T_J - T_C}{R_{\theta JC}}$$

Figure 20, Operating Frequency vs Collector Current

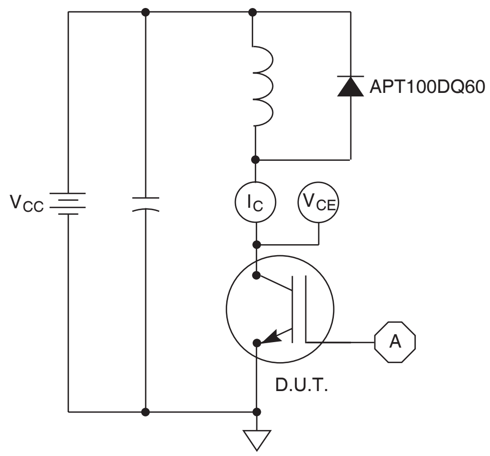


Figure 21, Inductive Switching Test Circuit

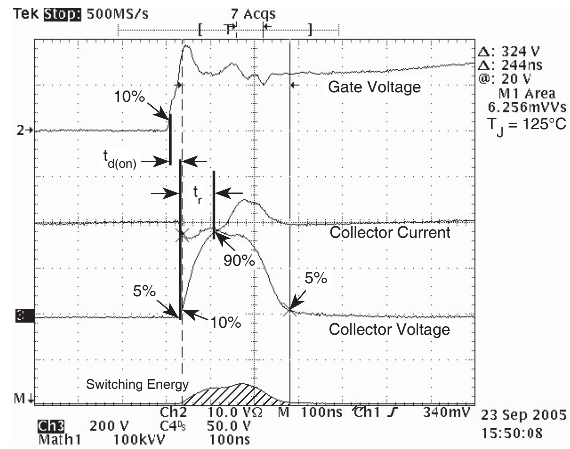


Figure 22, Turn-on Switching Waveforms and Definitions

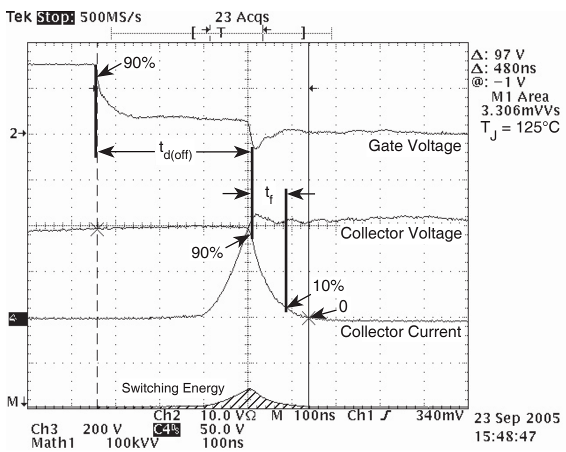
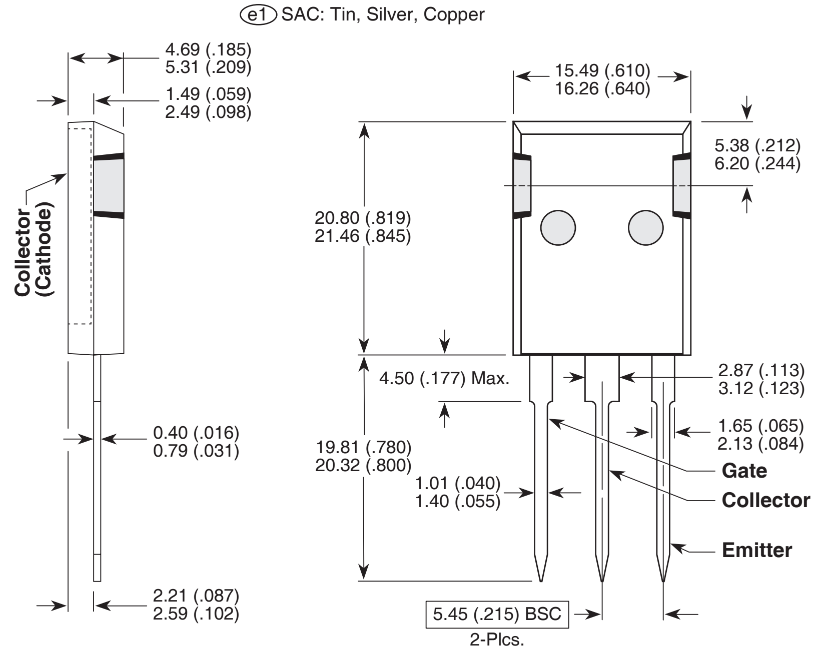


Figure 23, Turn-off Switching Waveforms and Definitions

T-MAX® (B2) Package Outline

e1 SAC: Tin, Silver, Copper



Dimensions in Millimeters and (Inches)